

## Constraints on deep crustal magma differentiation by U-series disequilibria of rocks from Southern Peru, Central Volcanic Zone

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The Central Volcanic Zone (CVZ) in the Andes is characterized by having the thickest continental crust (up to 70 km) of all convergent margin arcs. The historic trachyandesites and trachytes from the Andagua Valley, Southern Peru, have high Sr content and Sr/Y, but low Y and HREE contents [1], similar to the typical “adakite”. Geologic and geochemical evidence do not support their production by 1) melting of a young, hot or flat subducted slab; or 2) garnet fractionation from mantle-derived basaltic melt; or 3) anatectic melting of mafic lower continental crust or underplated basaltic magma. Instead, these signatures more likely form by crustal contamination and deep differentiation of mantle-derived magma in high pressure MASH zone [2].

We present U-series disequilibrium data for 20 Andagua lavas with SiO<sub>2</sub> ranging from 55.5 to 63.9 wt% to constrain the magma differentiation process at depth in the thickened continental crust. Except for three highly evolved samples with large variations in (<sup>230</sup>Th/<sup>238</sup>U) and U/Th, and low (<sup>231</sup>Pa/<sup>235</sup>U) (due to ageing effect and crystallization of accessory minerals, e.g. zircon and apatite), the Andagua samples have significant <sup>230</sup>Th and <sup>231</sup>Pa excesses. (<sup>230</sup>Th/<sup>238</sup>U) varies from 1.04 to 1.29 and (<sup>231</sup>Pa/<sup>235</sup>U) from 1.39 to 1.62, and positively correlate with SiO<sub>2</sub> content. This indicates that the crustal assimilate may be a melt from the mafic lower continental crust or underplated basalt, and it should have slightly greater <sup>230</sup>Th and <sup>231</sup>Pa excesses than the mantle-derived mafic melt. The <sup>230</sup>Th excess in this crustal melt is consistent with garnet-controlling partial melting, while <sup>231</sup>Pa excess cannot be explained by simple batch melting. Instead, it requires a low-porosity in-growth melting process during magma differentiation.

[1] Sørensen & Holm (2008) *J. Volcanology and Geothermal Res.*, **177**, 378-396. [2] Hildreth & Moobath (1988) *CMP*, **98**, 455-489.

## Influence of competitive adsorption on kinetics of microbial arsenate reduction

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Microbial reduction of arsenate (As(V)) to arsenite (As(III)) is known to increase the mobility and toxicity of arsenic in the environment [1]. In the presence of mineral surfaces, substantially slower As(V) reduction was observed, and reduction kinetics seemed to be controlled by the desorption of As(V) into the solution phase [2]. In natural systems, As(V) competes with other anions for adsorption to mineral surfaces. Up to date, the effect of competitive adsorption on As(V) reduction kinetics has not been specifically addressed. We therefore investigated As(V) reduction kinetics by *Shewanella putrefaciens* CN-32 in goethite suspensions in the presence of competitively adsorbing phosphate (P) and exopolysaccharide (EPS). Incubation experiments were carried out at pH 7.0 in solutions initially containing 10 µM As(V) and 25 µM lactate in the presence of 2 g goethite L<sup>-1</sup>.

In the absence of P and EPS, *Shewanella putrefaciens* CN-32 (1.0×10<sup>9</sup> cells mL<sup>-1</sup>) reduced As(V) with a half-life of 19 days (pseudo-first-order kinetics). Addition of up to 10 µM P increased initial dissolved As(V) concentrations but not reduction rates. However, increased As(V) reduction rates were observed in the presence of 50 and 100 µM P (half-life of 7 days). On the other hand, the half-life of As(V) also decreased to 10 days if the concentration of bacterial EPS was increased by 20% (spiking EPS isolated from bacterial cultures), indicating that EPS release by bacteria may also promote As(V) release from mineral surfaces [2]. Thus, both oxyanion competition and bacterial EPS production may enhance As(V) reduction in the presence of mineral surfaces. However, whereas increased As(V) reduction kinetics in the presence of 50 and 100 µM P were likely due to higher dissolved As(V) at the early stage of the incubation, spiking EPS appeared to enhance the As(V) reduction rate by steadily increasing the dissolved As(V) concentration during the entire incubation period.

[1] Smedley & Kinniburgh (2002) *Appl. Geochem.* **17**, 517-568. [2] Huang *et al.* (2008) *Geochim. Cosmochim. Acta* **72**, A399.